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Ken McNamara is Senior Curator of Invertebrate Palaeontology and Palaeobotany at the Western Australian Museum in Perth and Adjunct Professor of Palaeontology at Curtin University. He graduated from the University of Aberdeen with an honours degree in Geology and Mineralogy and obtained a Ph.D. from the University of Cambridge for work on stratigraphy and Ordovician trilobites from the Lake District in England. In his 27 years at the museum he has studied a wide of range of fossil invertebrates, and written more than 180 scientific papers, books and popular articles on many aspects of palaeontology.

Ken joined the Royal Society of Western Australia Council in 1985/86, serving for some 10 years. He was President in 1991/92. In 2006, Ken also was awarded the prestigious Australian Academy of Science *Mawson Medal*.

Ken McNamara's research has concentrated on using the fossil record to unravel the patterns and processes of evolution. The main focus has been on interpreting the patterns of evolution in terms of heterochrony – variations to the timing and rate of organisms' development. In addition to writing many papers on heterochrony he has co-authored the main textbook, written a popular book and edited two other books on the subject.

Star-Crossed Stones – the archaeology, mythology and folklore of fossil echinoids (Medal Address July 2005)

In his seminal book *Micrographia*, published in 1665, the great English physicist, astronomer, geologist, chemist, architect and microscopist Robert Hooke remarked that fossils 'do owe their formation and figuration, not to any kind of *Plastick virtue* inherent in the earth, but to the Shells of certain Shell-fishes which...came to be... fill'd with some kind of Mudd or Clay or *petrifying Water*, or some other substance, which in tract of time has been settled together and hardned (sic) in those shelly moulds into those shaped substances we now find them.' Like one or two other free thinkers on continental Europe, Hooke had come to realise that fossils were the remains of once living organisms. While this may be of no surprise to us today, in 17th century Europe such thoughts were not only radical, but verged on the heretical. Foremost in Hooke's interpretation were little fossils that he had collected as a boy on the Isle of Wight in southern England and which he called 'button-stones' and 'helmet-stones'. The former are what we now know as regular echinoids (sea urchins), the latter are another kind of echinoid called a heart urchin (see Fig. 1). Both occur commonly as fossils in Cretaceous and Jurassic rocks in England, through much of Europe and the eastern Mediterranean region.

While fossil echinoids subsequently played a significant early role in supporting Darwin's theory of



Figure 1. A 'shepherd's crown' the echinoid *Micraster* collected by Mr A. Smith from a field in Linkenholt, Hampshire.

evolution, for thousands of years earlier they had been the fossil that had most attracted the attention of humans. The presence of fossil echinoids in many archaeological deposits indicates that people have been collecting them for literally hundreds of thousands of years. By analysing the archaeological context in which fossil echinoids are found and also the folklore that has been attached to them, and which has survived into recent times, it is possible to reconstruct some of the myths that might have been associated with these star-crossed stones. Information from archaeology derives from two sources. One is from artificial alteration of the fossil itself, or of the rock on which it occurs. The second is from the archaeological association of the fossil, in other words where it was found and with what. For instance, many examples are known of fossil echinoids having been buried with human remains. There is evidence from many archaeological sites throughout much of Europe, the Near East and Northern Africa, that these fossils attained the status of cult objects, imbued with powerful spiritual significance. These magical powers have, over thousands of years, unwinded into the folklore that even well into the last century, saw them regarded as either apotropaic objects (capable of warding off evil) or objects that bestowed luck on their finders.

The earliest evidence for someone specifically collecting a fossil echinoid is from an Acheulian hand axe, crafted about 400,000 years ago and found in southern England at Swanscombe, Kent. Embossed on this hand axe is the fossil echinoid *Conulus*, preserved as a distinctive five-rayed star (Fig. 2). The collector of this flint, probably a member of *Homo heidelbergensis*, only worked one side of the axe. Had they worked the other side much of the fossil would have been destroyed. This points to the fossil having been collected and incorporated into a tool because of its aesthetic appeal, probably its five-rayed star pattern. Other Early Palaeolithic flint axes are known from France that similarly have fossil echinoids incorporated into them.

Although we can only conjecture, it is possible that the

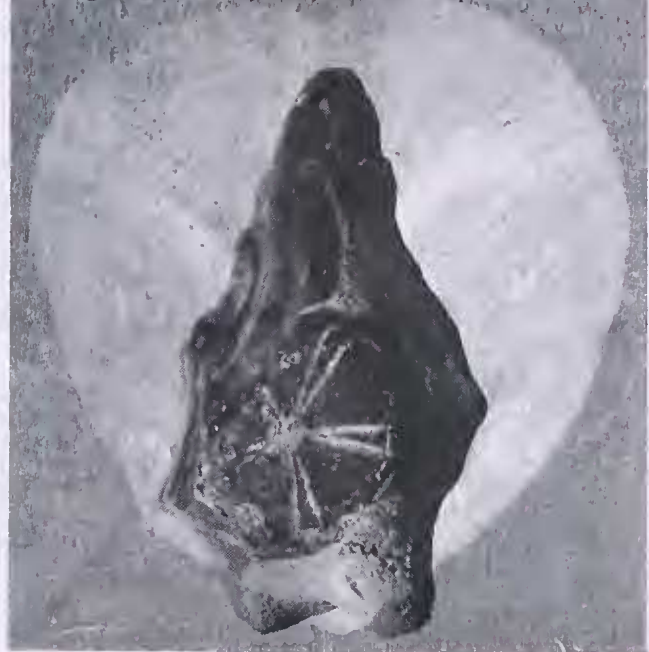


Figure 2. Acheulian hand axe, about 400,000 years old, from Swanscombe, Kent containing the echinoid *Conulus*.

fossil may have been thought to have imbued the axe with special powers. *Homo neanderthalensis* also appears to have taken a liking to fossil echinoids, distinctive Mousterian side scrapers having been found in France, some made entirely from the fossil, others incorporating them into the body of the tool. This tradition was continued in *Homo sapiens*. In recent years a large number of Neolithic flint tools have been found in Belgium that incorporated fossil echinoids.

It was during Neolithic times, after many societies had given up their nomadic hunter-gatherer existence and established permanent settlements, that we first find evidence of fossil echinoids being used as grave goods. In most cases where they have been found in this context, they are either the sole or dominant grave good. Often a single fossil was placed in a grave with the body. However, examples of large barrows (burial mounds) are known from Brittany that upon excavation have been found to contain nothing but a single fossil echinoid – not even a body. This signifies the attachment of a high spiritual significance to these fossils in northern Europe during Neolithic times.

Burial of fossil echinoids with bodies became quite extreme on occasions. In one Bronze Age grave near Dunstable in England the remains of a young woman and child were found with more than 300 fossil echinoids buried with them. The most extreme example, though, was a Bronze Age site near Hercourt in France, where a tomb was uncovered that contained a single human skull, a cup made from a deer's horn and what



Figure 3. Drawing by Worthington G. Smith of skeleton of woman and child in grave with more than 300 fossil echinoids that he excavated near Dunstable in 1887.

was estimated to be 2 to 3 cubic metres of fossil echinoids. It has been calculated that this could represent up to 30,000 fossils.

The discovery of a fossil echinoid with a stone axe in a pot in an Iron Age cremation deposit in Kent in southern England, indicates a link with Norse mythology through the god Thor. Folklore gathered in Denmark and southern England in the early 20th century indicates that both fossil echinoids and stone axes were called 'thunderstones'. These were thought to have been thrown to Earth by Thor. This god was not only a thunder god, but also the peasant's god who protected them. Thus these fossils were placed near windows and doors not only to ward off lightning strikes, but also to protect the house from evil. Other folk names given to fossil echinoids in England include 'shepherd's crowns' and 'fairy loaves'. Both of these names are likely to have derived from Celtic or pre-Celtic terms and beliefs in the association of these object with the afterlife. Their frequent occurrence in burial mounds (sites of passage from this life to the next), points to a significance attached to the fossils associated with ensuring the rebirth of their bearer. These spiritual beliefs degenerated in Christian times into folk traditions of 'good luck' associated with the fossils, such that 'fairy loaves' were thought to help keep the milk fresh and ensure that the bread would rise.

Fossil echinoids appear to also have been significant in the Mediterranean region from at least as far back as the Neolithic. However, they are only rarely found associated with burials. They seem to have had a more practical use, for many had holes drilled through them so they could be used as spindle whorls. However, even here the use of objects with the five-rayed star pattern suggests their use may also have had some degree of spiritual significance. A drilled fossil from one of the earliest Neolithic settlements in the eastern Mediterranean, 'Ain Ghazal in Jordan, may well have been used as a fertility object, due to the location of the hole (see Fig. 4). Other fossils from Neolithic and Iron Age sites in Jordan have been altered to enhance the five-rayed pattern. It is possible that this was seen to be representative of the human form, akin, in Renaissance times, to Leonardo da Vinci's Vitruvian Man.

One of the most spectacular fossil echinoids is one found at Heliopolis in Egypt. Hieroglyphs were inscribed on this fossil in about 1500 BC informing us of the name of the priest who found it and where he found it – the quarry of Sopdu, a god sometimes known as the 'Morning Star'. The presence of a distinct five-rayed star



Figure 4. Fossil echinoid *Coenholactypus* with drill hole, from Neolithic site, 'Ain Gazal, Jordan. Possibly used as a fertility symbol, the five-rayed pattern perhaps seen as representative of the human form.

on this fossil, and the extensive use of this symbol by ancient Egyptians in their burial chambers to symbolise the stars in the sky to which the spirit of the pharaoh returned, suggests that these fossils might have played an important role in Egyptian funeral rites.

The apotropaic powers that fossil echinoids are thought have possessed shows a close parallel with the same attributes of the five-rayed star symbol on its own. This symbol was in use as far back as nearly 5,000 years ago in Mesopotamia. The mediaeval knight Sir Gawain had one on his shield because it symbolised chivalry, courtesy, piety and kindness. It was used commonly in mediaeval times above doors of houses or stables, or on cots, to keep the devil at bay. Perhaps emulating this belief, the presence of fossil echinoids placed around windows on a mediaeval church in Hampshire in southern England might be thought to have functioned in a similar way. Given the very long fascination that humans have had with fossil echinoids, it is not unreasonable, I believe, to consider that the five-rayed star, that today is one of the most ubiquitous of all symbols, had its origins in people's captivation by these star-crossed stones.